IEM's AI Modeling: Short-term COVID-19 Projections

Date: 9/10/20

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 9/10/20 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

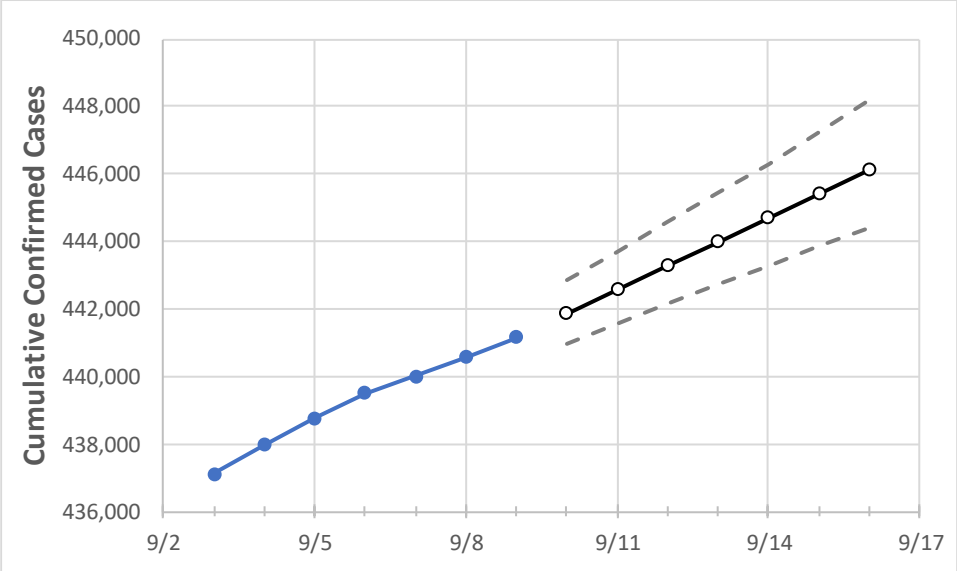
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

New York State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
New York	439,501	440,021	440,578	441,154	441,862	442,571	443,280	443,990	444,702	445,414	446,127

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 20%, and are often within 10%, of actual confirmed cases.

New York Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Albany	2,831	2,833	2,840	2,846	2,852	2,857	2,862	2,867	2,872	2,877	2,882
Bronx	51,912	51,944	51,984	52,018	52,058	52,096	52,134	52,170	52,205	52,239	52,273
Dutchess	4,928	4,939	4,944	4,956	4,965	4,974	4,982	4,991	4,999	5,008	5,016
Erie	10,266	10,320	10,346	10,394	10,453	10,513	10,574	10,635	10,698	10,761	10,825
Kings	65,626	65,700	65,757	65,819	65,908	65,997	66,087	66,177	66,267	66,358	66,449
Monroe	5,572	5,585	5,602	5,615	5,629	5,642	5,656	5,669	5,682	5,694	5,707
Nassau	45,193	45,229	45,294	45,372	45,456	45,542	45,630	45,721	45,814	45,911	46,010
New York	32,426	32,442	32,461	32,500	32,534	32,567	32,599	32,631	32,662	32,692	32,722
Niagara	1,650	1,654	1,659	1,663	1,668	1,673	1,678	1,683	1,688	1,693	1,698
Onondaga	3,983	3,993	4,002	4,012	4,024	4,036	4,048	4,059	4,071	4,082	4,094
Orange	11,515	11,525	11,535	11,552	11,565	11,578	11,591	11,604	11,617	11,630	11,644
Putnam	1,531	1,534	1,539	1,541	1,545	1,550	1,555	1,560	1,565	1,570	1,575
Queens	70,625	70,675	70,766	70,824	70,888	70,952	71,016	71,079	71,142	71,205	71,267
Rensselaer	859	860	865	866	868	871	873	876	878	881	883
Richmond	15,420	15,451	15,466	15,486	15,510	15,535	15,561	15,587	15,615	15,643	15,672
Rockland	14,396	14,418	14,439	14,459	14,484	14,511	14,538	14,566	14,595	14,625	14,656
Saratoga	889	893	900	911	920	929	939	950	961	973	987
Schenectady	1,310	1,314	1,322	1,324	1,328	1,332	1,336	1,340	1,343	1,347	1,350
Suffolk	45,258	45,304	45,356	45,411	45,481	45,553	45,628	45,704	45,784	45,865	45,950
Sullivan	1,544	1,544	1,544	1,544	1,546	1,548	1,550	1,552	1,555	1,557	1,559
Tompkins	332	339	344	346	350	357	364	371	379	385	393
Ulster	2,201	2,203	2,203	2,203	2,206	2,208	2,211	2,213	2,216	2,218	2,220
Westchester	37,246	37,277	37,314	37,355	37,399	37,444	37,489	37,534	37,580	37,627	37,675

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

New York Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	9/6	9/7	9/8	9/9	9/11	9/13	9/15
Albany	2,831	2,833	2,840	2,846	2,857 (571) [137] {69}	2,867 (573) [138] {69}	2,877 (575) [138] {69}
Bronx	51,912	51,944	51,984	52,018	52,096 (10,419) [2,501] {1,250}	52,170 (10,434) [2,504] {1,252}	52,239 (10,448) [2,507] {1,254}
Dutchess	4,928	4,939	4,944	4,956	4,974 (995) [239] {119}	4,991 (998) [240] {120}	5,008 (1,002) [240] {120}
Erie	10,266	10,320	10,346	10,394	10,513 (2,103) [505] {252}	10,635 (2,127) [510] {255}	10,761 (2,152) [517] {258}
Kings	65,626	65,700	65,757	65,819	65,997 (13,199) [3,168] {1,584}	66,177 (13,235) [3,176] {1,588}	66,358 (13,272) [3,185] {1,593}
Monroe	5,572	5,585	5,602	5,615	5,642 (1,128) [271] {135}	5,669 (1,134) [272] {136}	5,694 (1,139) [273] {137}
Nassau	45,193	45,229	45,294	45,372	45,542 (9,108) [2,186] {1,093}	45,721 (9,144) [2,195] {1,097}	45,911 (9,182) [2,204] {1,102}
New York	32,426	32,442	32,461	32,500	32,567 (6,513) [1,563] {782}	32,631 (6,526) [1,566] {783}	32,692 (6,538) [1,569] {785}
Niagara	1,650	1,654	1,659	1,663	1,673 (335) [80] {40}	1,683 (337) [81] {40}	1,693 (339) [81] {41}
Onondaga	3,983	3,993	4,002	4,012	4,036 (807) [194] {97}	4,059 (812) [195] {97}	4,082 (816) [196] {98}
Orange	11,515	11,525	11,535	11,552	11,578 (2,316) [556] {278}	11,604 (2,321) [557] {278}	11,630 (2,326) [558] {279}
Putnam	1,531	1,534	1,539	1,541	1,550 (310) [74] {37}	1,560 (312) [75] {37}	1,570 (314) [75] {38}
Queens	70,625	70,675	70,766	70,824	70,952 (14,190) [3,406] {1,703}	71,079 (14,216) [3,412] {1,706}	71,205 (14,241) [3,418] {1,709}
Rensselaer	859	860	865	866	871 (174) [42] {21}	876 (175) [42] {21}	881 (176) [42] {21}
Richmond	15,420	15,451	15,466	15,486	15,535 (3,107) [746] {373}	15,587 (3,117) [748] {374}	15,643 (3,129) [751] {375}
Rockland	14,396	14,418	14,439	14,459	14,511 (2,902) [697] {348}	14,566 (2,913) [699] {350}	14,625 (2,925) [702] {351}
Saratoga	889	893	900	911	929 (186) [45] {22}	950 (190) [46] {23}	973 (195) [47] {23}
Schenectady	1,310	1,314	1,322	1,324	1,332 (266) [64] {32}	1,340 (268) [64] {32}	1,347 (269) [65] {32}
Suffolk	45,258	45,304	45,356	45,411	45,553 (9,111) [2,187] {1,093}	45,704 (9,141) [2,194] {1,097}	45,865 (9,173) [2,202] {1,101}
Sullivan	1,544	1,544	1,544	1,544	1,548 (310) [74] {37}	1,552 (310) [75] {37}	1,557 (311) [75] {37}
Tompkins	332	339	344	346	357 (71) [17] {9}	371 (74) [18] {9}	385 (77) [18] {9}
Ulster	2,201	2,203	2,203	2,203	2,208 (442) [106] {53}	2,213 (443) [106] {53}	2,218 (444) [106] {53}
Westchester	37,246	37,277	37,314	37,355	37,444 (7,489) [1,797] {899}	37,534 (7,507) [1,802] {901}	37,627 (7,525) [1,806] {903}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.